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ABSTRACT

Despite the ever-increasing number of higher education institutions offering online courses, there are still a lot of controversial debates and a strong sense of confusion about how well the concept of Web-based distance learning is being implemented. This paper summarizes the 10 primary steps toward the assessment, planning, design, implementation, and maintenance of a successful virtual classroom. Benefits and drawbacks of a Web-based classroom are first outlined, followed by these 10 steps: (1) Assess the needs and the necessary conditions to satisfy them; (2) Estimate the development cost, effort, and implications; (3) Plan the virtual classroom; (4) Design the virtual classroom; (5) Prepare and distribute contents; (6) Enable communication; (7) Implement online student assessment methods; (8) Implement class management procedures; (9) Set up the system; and (10) Maintain and update the virtual classroom. (AEF)

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How to Design a Virtual Classroom: 10 Easy Steps to Follow!

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Abstract

There has been a transparent explosion of Web based courses in the past few years. Despite the ever-increasing number of higher education institutions offering online courses, there is still a lot of controversial debates and a strong sense of confusion about how well the concept of Web-based distance learning is being implemented.

This paper is an effort to summarize the primary steps towards building and implementing a successful concept of a virtual classroom. The article should help its readers on how to get involved in the assessment, planning, design, implementation, and maintenance of a virtual classroom-in ten easy steps for the reader to follow.

The authors of this paper do not claim that by following the steps outlined in this paper will unequivocally lead to an absolute success; however, there are good reasons to believe the opposite is true. In other words, failing to follow these guidelines will almost inevitably lead to poor, incomplete, inadequate, ineffective solutions to Internet-based distance education.

Introduction

Before attempting to describe the steps towards a successful implementation of a virtual classroom, let us start with a few basic and important definitions.

A classroom can be defined as communication system that makes it possible for a group of people/users to come together to dialogue about something they want to learn, and to look at visuals (pictures, diagrams) and text that might aid them understand. The conventional classrrom is surrounded by walls that provide protection from outside noise and interference, contributing to a more effective learning process. [5]

A virtual classroom, on the other hand, is a system that provides the same opportunities for the teaching and learning process beyond the physical limits of the traditional classroom's walls, thanks to the use of computer communication networks. Due to the ubiquity and popularity of the Internet - particularly the World Wide Web - most virtual classroom implementations are Web-based. It is a perplexing devoir to assess the size of the Internet! However, according to Classroom Connect [14], more than 40,000 new Internet services and Internet information sites become available each month, providing services to approximately 20 million users in more than 50 countries - making the world a smaller place. In today's technology, the expression Web-based classroom and virtual classroom can be considered synonym [15].

Some of the benefits of a Web-based classroom are [4]: geographic, temporal, and platform independence; simple, familiar, and consistent interface. Also, the use of the computer processing power and the sustematic design of instructions to mediate and deliver effective information, creation and distribution process of instruction.

Some of its drawbacks are [4]: limited access to the Internet worldwide and associated costs; resistance to shift to new and alternative teaching and learning paradigms or methodologies; privacy, security, copyright, and related issues; lack of uniform quality.

The use of the Web for distance education has experienced explosive growth in the past two or three years. A plethora of Web-based courses in virtually any field of knowledge is now available worldwide. Despite the numerical growth on the number of online courses, it does not take too long them browse through some of them and realize that there are many poor implementations of the concept of virtual classroom and the lack of quality and authentic distance education (DE) [16].

On top of that, at a more conceptual level, there is also a heated ongoing debate about the way by which the Web has been used to foster learning. Many experts claim that the majority of online courses available today on the Web do little more than converting the course content into HTML pages interleaved with a few quizzes and some other features that do not effectively contribute to the process of learning [1] [2] [3]. They claim this model inherits most of the disadvantages of the traditional, predominantly unidirectional, lecture format and none of its advantages, such as the ability of raising questions or interacting with teammates while

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working on a common project. Some even say that the Web might be our last opportunity to fix century-old problems and start teaching "the right way" [2].

In this paper we summarize the process of conceiving, planning, designing, implementing, and maintaining a virtual classroom in ten easy-to-follow steps. The paper is aimed at the reader who has a previous understanding of the basics of Web-based education and wants a structured simplified view of the steps that ought to be taken in order to successfully implement a virtual classroom.

Before rushing into design a virtual classroom, we encourage the used to follow the steps outlined in this paper, answer all the corresponding questions, and anticipate the possible scenarios before assigning any resource or committing to a final result. Also, the authors have created the V-model, Fig 1, for the convenience of accessing the information in this article to graphically communicate the concept and any needed information.

Step 1 - Assess the needs and the necessary conditions to satisfy them

We begin assuming that the reader have very basic knowledge of virtual classroom concepts, pros, and cons and wants to perform a feasibility analysis before proceeding into actual inmplementation. The main purpose of this step is to assure the existence of a need for the proposed virtual classroom and the basic infrastructure to develop it. Simply you assess 'what is', current state of conditions, available system, etc., and 'what ought to be,' desired output. By assessming what is and what ought to be, you have assessed the need and figured out a gap to be bridged [16]. Thus, some questions that should be answered at this stage are:

- *Are there remote students for that course?*
  This is simple, though essential, question of economics. Unless there is a minimum number of (remote) students who will benefit from the virtual classroom implementation, the initiative will be seen by the upper management as a waste of time, money, and resources.

- *Will they be able to access the course site and perform all the necessary interactions?*
  Web-based education assumes the remote student will have the necessary technical conditions to access the course contents from his/her personal computer. The minimal hardware, software, Internet connection requirements must be assessed in advance and their costs estimated.

- *Is there institutional support and interest?*
  A virtual classroom is normally too big of a task to be carried out alone without the explicit support from the institution. Support must be present in terms of funding, time allocation, technical resources, and investing in a well-trained staff - a valuable human capital investment.

- *Are there administrative policies and procedures for these cases?*
  Implementing an online version of an existing course or creating a new, Web-based only, course will probably require changes in some administrative policies and procedures. Some of these are: registration, admission, fees, prerequisites for taking the course, and withdrawal from the course, to name a few. There ought to be a clear agreement on those issues before the course is offered.

Step 2 - Estimate the development cost, effort, and implications

At this point, it is assumed that the basic needs and the necessary conditions to satisfy those needs have been assessed. In other words, the approach looks feasible enough to move one step further and start talking about numbers. The main purpose of ths step is to reach a clear, accurate, quantitative estimate of the overall cost of developing the virtual classroom. Some important questions at this stage are:

- *How long is it going to take develop the virtual classroom?*
  It is always hard to estimate the duration of a project and the development of a virtual classroom is no exception. A good way to break down this question and achieve a reasonably accurate estimate would be to quantify (in persons-month, PM) each and every stage of the detailed implementation plan. A warning is in place here: content creation, conversion to digital format, and manipulation takes much longer than one might originally expect.

- *Which tools will be needed? How much will they cost? Which equipment will they require?*
  A complete list of hardware and software tools, their cost, and corresponding hardware/software requirements should be produced. It is always important to keep in mind that there is a minimum set of requirements (hardware and software to produce and distribute a pure HTML-based course) that can incrementally (and

sometimes, exponentially) grow as more sophisticated features are added. Be sure to draw the line at a reasonable compromise of technical features versus cost.

- *How many people with which specific will be needed?*

Creating and maintaining a Web-based course is certainly not a one-man effort. There are many tasks complex enough to be assigned to specific people with the required technical skills. Examples of those are: graphical creation and manipulation, CGI-based programming, software assessment and evaluation, Java programming, network setup and maintenance, to name a few. Assigning these independent tasks to different people with the proper background will reduce significantly the overhead on the instructor's routine, at the expense of hiring and maintaining the technical staff. At the bare minimum we dare to suggest an instructional technology staff of two versatile, motivated, and creative individuals: one for graphics/media creation, digitization, and manipulation; another one for Web-based programming and instructional design.

- *How much will the development impact the instructor's workload?*

Developing a virtual classroom will add a significant amount of work to the instructor's (already busy) daily routine. This extra effort should be quantified (and limited to a certain maximum, if possible) beforehand and measures should be take to work around the impact of the new tasks on the instructor's overall schedule. One of these measures includes hiring technical support staff (see previous question).

- *How much will it impact the teaching methods used so far?*

Teaching a course using the Web is, or at least should be, much more than merely converting the course notes into HTML format and adding appropriate links. There is a whole adaptation process (in which it will result in many changes to policies, strategies, administration, curriculum offerings, and the way by which the course is delivered and learning is assessed) that will take place. In academia, the Internet is not a mere entertaining media or an electronic recreational medium. Its existence in education should be utilized to meet educational purpose and achieving learning and teaching goals. If utilized with such a purpose and goals in mind, learning by exploring and discovery, in such a context rich environment, will result in a meaningful learning, the development of students' metacognitive skills, and the development of higher order thinking skills that will strongly impact the learning and the teaching process [15] [16] [17]. Thus, if an institution sensed the need for such changes, a committee composed of computing and technology professionals should be appointed to approve or disapprove the need for changes - in order to ensure the quality and consistency of the institution's offerings [4]. Even when this is not the case, it is nevertheless important to predict the changes and smooth out the transition and adaptation process.

- *What are the institution's Web publishing and Internet access policies?*

It is essential to check whether the institution has a Web publishing policy, what does it say, who is responsible for enforcing the rules and whether or not there are tools to help developers meet the policy's specifications.

- *How much of the total contents are already available in electronic format?*

Considerable time and work can be saved if part of the course contents already exist in electronic form. Text can be easily converted into HTML format. Digitized images, audio, and video can be edited and incorporated into the virtual classroom much more easily than when text typing, image scanning, audio recording, and video shooting have yet to be performed.

- *What will be the software/hardware requirements for the client (student) machine?*

The student's machine must follow a minimum set of specifications including hardware (CPU, RAM, and disk size), operating system, and application software (Web browser and plugins, e-mail software, word processor) requirements. Of course these requirements will always be changing and must be updated accordingly.

- *What will be the software/hardware requirements for the server machine?*

The Web server specifications include hardware (CPU, RAM, disk size, etc.) operating system, and application software (Web server, mail server, newsgroup server, CGI server, etc.) requirements. Once again, these requirements must be updated as technology evolves.

Step 3 - Plan the virtual classroom

After having estimated the overall cost of developing the virtual classroom, assessed its impact on existing structures, and established some of its minimum requirements, it is time to look more closely at the project from an educational perspective. Some questions to help assessing the pedagogical feasibility of the proposed project are:

- *What are the educational goals?*

The primary purpose of building a virtual classroom should be to improve the experience of the students and instructors, rather than to play with new technology. Developing a list of educational goals is an essential part of the planning process. It is strongly advisable not to go ahead without figuring out which goals must be reached. Difficulties in coming up with such a list might be a warning about the overall validity of the approach. Examples of such goals are [4]:

- Ensuring that all students and teachers have equal access to instructions and receive all instructional material on time.
- Providing students with on time, continuous, and frequent feedback opportunities to assess their understanding and skills of subject matter.
- Supplementing theory with a variety of practical tutorials and activities. Theory and application should be interwined and inseprable entities.
- Increasing student-to-student and student-to-instructor - in and outside lectures.
- Systematic planning based on the realization that the purpose behind any technology in education, is for it to be utilized as a tool to aid the learner's knowledge construction, a tool for exploration and discovery, an interactive and creative context to support learning-by-doing, a social medium to support learning by conversing, sharing, and debating information and constructing knowledge [15] [16] [17].

- *How will these goals be accomplished?*

After having set educational goals to be accomplished, it is time to specify how to achieve them. It is brainstorming activity whose effectiveness can be increased by following some guidelines such as [4]:

- Try to innovate approaches (be creative) and do not restrict yourself to existing methods or traditional strategies.
- Keep in mind the class's characteristics, needs, and know your audience.
- The Web is only one of the tools. Do not use the Web for everything.
- Use diverse approaches of reaching your educational goals and reaching out for your students.
- Share your experiences with other educators and attempt to learn from their own experience.
- Try our new maxim: "Keep it simple and creative!" (KISAC).

- *Which goals will possibly **not** be accomplished and how can we compensate for them?*

It is known from the beginning that a virtual classroom will present several limitations. It is important to anticipate those shortcomings and derive ways to overcome them. In a purely distance-based course, there will probably be little left to do. In a hybrid (live + Web-based) approach, live interactions should prioritize these goals and engage students in activities that will contribute to their achievement.

- *Which approaches could be used to achieve a given goal? Which of them is more viable?*

It is very easy to understand, or at least accept, that even within the realm of Web-based distance education, there are several different ways of achieving the same educational goal. Student-to-instructor communication, for instance, can be

achieved through e-mail, live chat, audio or video conferencing.

A Web-based education project in [8] used a What-Why-& How table in its initial development stage to track down the desired educational goals, the reasons why each goal was listed and the several ways by which that goal was listed and the several ways by which that goal could be accomplished. In a later, stage, the various alternatives to implement the same goal were evaluated and the best overall option (taking into account issues such as: cost of implementation, hardware/software requirements, user friendliness, etc.) was implemented.

Step 4 - Design the virtual classroom

Now that the pedagogical aspects of the proposed project have been assessed, it is time to start the actual design process. Here are some questions to help at this stage:

- *How will the (maybe thousands of) HTML pages be structured?*

The HTML pages containing the course material should be organized in a way that makes navigation easy, simple, and consistent (from the user's point of view) and reduces the amount of work necessary for site maintenance (from the instructor's/administrator's point of view). Part of these objectives can be achieved by providing a suitable overall structure for the pages. There are several good ways of organizing the pages and their interdependencies, such as hierarchical tree, or linked list. Regardless of the organization strategy, the final outcome should always provide for a user-friendly, easily maintainable, navigation scheme.

- *Can we provide a (preferably consistent) "look-and-feel" for the Web pages?*

The course's HTML pages must necessarily have something in common, both for aesthetic as well as functional reasons. Much work is saved if a small set of pages with little or no content is developed before the actual course contents are converted into HTML format. These pages can be useful to test the "look-and-feel" of the whole site, and can eventually be used as templates for everything else. Spending some time at this stage can save substantial amount of maintenance work down the road.

- *What should be the layout for a typical course page?*

After having decided on the basic template for the course pages, it is time to refine it, making sure all the necessary and desirable elements will be there. Navigation buttons are of utmost importance, regardless of their appearance. At the very least the user should be able to know, just by looking at any HTML page, where she is, how to move forward, backward, up, or down, and how to go back to the course main page. Chapter 3 of [4] provides more details and examples of page layouts.

- *How fancy should the pages be? What is the related hardware/software/ technology impact?*

Developing Web pages with today's tools make it very tempting to include images, animations, applets, sounds, links, and even excessive plain text that might clutter the pages, slow down the transfer of information to the remote clients, and contribute little, or not at all, to increase the effectiveness of the project. Before adding any item to a page one should ask how much that piece of data will add to the overall educational goals of the course and what is the price to pay (slower transfer, more strict hardware requirements, need for special plugins, etc.). It is essential to strike a balance and use discretion when adding objects to the course's site.

Step 5 - Prepare and distribute contents

- *Which authoring tools should be used?*

Writing pure HTML code in a text-based editor may still be the preferred way to go for several people with computer programming background, but there are more, friendlier, and better alternatives to it. It is strongly advisable to research, compare, and evaluate Web-design tools and supplementary software before adopting a certain set of tools. Changing lanes at the middle of the road might be costly and troublesome.

For HTML editing, one can choose from simple, free tools, such as Netscape Composer (companion to the Navigator browser), to fully featured packages such as

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Macromedia Dreamweaver or GoLive CyberStudio. Platform capability is an important issue. While products such as Adobe PageMill have both Mac and PC versions, other are bounded to a specific machine/operating system, such as GoLive CyberStudio (available only for the Macintosh). A list of authoring tools and corresponding reviews is available at [11].

Using more than one tool to edit the same page can lead to problems, ranging from the harmless though annoying "war" between their extra HTML meta tags to serious compatibility issues.

A final suggestion is in place: try before you buy. Many of those tools have downloadable demo versions available on the Web. Try them out and choose the one that best suits your needs.

- *How to import, create, edit images?*

Images can be acquired in several ways, such as: scanning printed pictures, taking your own pictures using digital still cameras, capturing digitized video frames, or buying CDs containing collections of high-quality images related to a certain subject.

Images can also be easily created, edited, processed, and manipulated using numerous software titles, such as: Graphic Workshop, ACDSee, PaintShop, etc. The final result should always be stored in either GIF or JPEG format to be easily and directly included in an HTML page.

- *How to import, create, edit sounds?*

There are several possible sources of sounds and many tools (some of them available in the software bundle that comes with a new PC) to import, create, and edit digitized audio files.

Low quality sound recording is easily accomplished using an inexpensive desktop microphone. High quality sound recording and processing requires more expensive devices and software tools and is a much more difficult and time consuming task. Moreover, the higher the quality of the audio file (stereo, high number of bits per sample, high sampling rate, etc.), the longer it will take to transfer it through the network.

There are many audio file formats currently in use, such as .WAV, .AU, .AIFF, and the new .MP3 (MPEG-3) format.

- How to import, create, edit graphics and animations?

Before reading further a question is in order. If you don't have anyone in the supporting staff (including yourself) specialized in graphics and related areas, forget extensive use of animations, graphics, virtual reality and so forth and move to the next question.

If you do, make sure you address the impact of the hardware, software and time required for these tasks and be prepared to justify the pedagogical reasons for using a given amount of graphics in your courseware. Depending on the course contents, there may be many or none at all.

The most popular way of animating pictures is client-side animation using the GIF89a graphic file format. There are numerous tools available on the Web for animated GIFs creation and editing as well as for converting digitized video into animated GIF format.

- How to import, create, edit videos?

Video creation, processing and distribution normally require extensive and expensive hardware and software support. Digital video cameras are just starting to appear in the market, and meanwhile the best solution is to use an analog camera and a VCR and convert the resulting video into digital format using specialized didgitizing boards. Very large hard disks should be set aside to store digitized, compressed video clips.

There are several popular video formats such as: MPEG (.MPEG or .MPG), QuickTime (.QT or .MOV), and Microsoft's .AVI. The final quality of previously downloaded video exhibition will strongly depend on the client's hardware and will very likely be poor in terms of resolution, size and/or frame rate. If synchronous video transmission is desired, several network parameters (bandwidth, delay, congestion, and jitter) will also play a role and contribute to degrade the playback at the client machine even further.

Despite the power of video as an educational tool, the relatively high cost and low quality of today's digital video transmission across the Internet puts a limit on its usefulness and cost effectiveness.

- *Where will the Web pages be posted?*

The virtual classroom should be hosted in a fast, reliable, machine, with a high bandwidth connection to the outside world.

Step 6 - Enable communication

Effective communication between instructor and students and among students themselves should be a high priority issue during the design of the virtual classroom. Some pertinent questions are:

- *Which form of communication?*

There are basically two possible ways of implementing communication between instructor and students in a virtual classroom: synchronous and asynchronous.

Synchronous communication tools, such as ClassPoint or NetMeeting, allow the instructor to teach live lectures through the Web using resources such as audio and video conferencing, white board and text-based chat. Students can interact by asking questions, normally using a text window. Some type of floor control is normally desired, to prevent chaos and ensure that students will have their questions answered in a First Come First Served (FCFS) basis.

Asynchronous tools allow information to be placed for future processing. Some common examples are: e-mail, bulletin board systems, mailing lists, and the course pages themselves.

A successful virtual classroom implementation should use both synchronous and asynchronous techniques to enable one-to-one (normally instructor-to-student), one-to-many (typically instructor-to-class) or many-to-many (e.g. threaded discussions) interactions.

- *Which tools should be used?*

At this point we are back to the What-Why-How model described before. It must be clear which educational goals are to be achieved using communication tools, why are these goals important, and which ways are available to implement them.

Let us take the popular concept of *virtual office hours* as an example. Why do we want virtual office hours? Basically to make the instructor available to answer students' questions in predetermined days and times. How can we implement that concept? Anything from conversational e-mail to fancy, sophisticated videoconferencing will do it, each of which has different costs, requirements, and effectiveness.

Today's virtual classrooms can use e-mail, chat rooms, mailing lists, Usenet newsgroups, audio and video conferencing, MUD (Multi-User Dimensions)/MOO (MUD, Object Oriented), and many other tools to enable various forms of interaction between instructor and students and among students themselves.

Step 7 - Implement online student assessment methods

Teaching without assessing the amount of content that has been learned is hardly acceptable. It is well-known that even the most conscious, mature students do not reach their highest potential limits if they are not challenged by some sort of systematic evaluation. The following questions address the problem of assessing the student performance in the virtual classroom environment.

- *Should the virtual classroom contain quizzes?*

An online quiz is typically a form, displayed in a browser window, with questions and spaces where students place their answers. When the student is done answering the questions, she presses a button to submit it for grading.

The main motivation for quizzes lies in the need for fast, frequent feedback, both for the instructor and the student, about the amount of information learned so far. Some of the problems found with online quizzes are [4]: encouraging rote learning, encouraging cue seeking, and fostering a false sense of confidence.

There are several tools for creating online quizzes, such as Jquiz, Test 2000, and Test Creator. Moreover, fully featured packages, such as WebCT [13], have their own quiz creation module.

- *What about online assignments?*

Assignments, as opposed to quizzes, aim at evaluating whether the student have acquired a more thorough competence in a topic or just understood the basics of it. For a more complete comparison between assignments and quizzes, see table 7.1 of [4].

- *Should we provide some kind of student evaluation?*

An evaluation is another method of assessing the student's activities or abilities and can appear in several forms, such as [4]: peer review, self-review, access records, level of participation in discussions, and so on. The communication tools discussed in step 6 and the course management tools normally available in packages such as WebCT could be combined to provide multiple ways of students' evaluation.

- *How tests are implemented online?*

Online tests can be considered a special case of quizzes, in which extra restrictions (e.g. number of attempts, time to finish) are added and a more strict way of student's identity verification and cheating prevention is used.

- *What about cheating?*

The main issues behind cheating prevention are: impersonation and security. Some possible solutions involve: requiring the presence of a proctor close to the student while she is taking the test; establishing a time window during which all the students should attempt the test (avoiding impersonation of a colleague at a later time), using randomly selected and sorted questions out of a (much) larger repository of possible questions.

No matter the strategy, there will always be the possibility of cheating, as there has always been in conventional classroom environment.

- *How will assignments, tests, etc. be submitted, graded, and returned to students?*

Online quizzes and tests will normally be made available through a Web-based form and submission of results should be as simple as pressing a button when done. For other assignments, the most common way of submission is e-mail with attachments. There are, however, better automatic ways for assignment submission, such as the HWSAM system [12].

Grading will strongly depend on the nature of the assignment, quiz or test. An online quiz composed only of multiple-choice questions can easily be graded (and the grade immediately sent back to the student, if desired) automatically. An extensive assignment or project might require manual intervention of the instructor, sometimes working on a printed version of it.

Step 8 - Implement class management procedures

Class management tasks are the clerical and administrative tasks necessary to ensure that a classroom operates efficiently [4]. These are tasks that many educators wish they did not have to perform, even knowing their importance for the operation of a class. It is natural to expect a computer-based virtual classroom to have some automatic tools to make these tasks easier and in fact many tools, such as WebCT, include class management modules. Some questions that may arise are:

- *Which type of class management information is relevant?*

The exact list of items that should be kept track of by the instructor may vary from course to course or even for different instructors of the same course, but they will very likely be a subset of the following:

  - Student tracking, to check students' progress along the course.

- Time-tabling and scheduling, to ensure that all students know when, where, and what they are expected to do in order to complete the class.
- Class promotion, to ensure a minimum enrollment and to clarify the purpose and requirements of the class to enrolled students.
- Student counseling to provide the help students might need to complete their studies.
- Information management, meaning the retrieval, update, and management of students' personal and academic data.
- Assignment management, including submitting, distributing, grading, and moderating assignments.
- Grades collection, moderation, and distribution.
- Archiving of class-related information and records.

- *Which tools can be used to perform those tasks?*

It is very unlikely that a single tool will provide the necessary help for all the different management tasks. Instructors can use built-in tools, such as WebCT's "Student Tracking" module, create and maintain their own databases, or rely on separate tools for specific tasks, such as HWSAM, for assignment submission.

Step 9 - Set up the system

It is now time to get a little more technical and discuss some issues involved in setting up the system and making the virtual classroom available. Some of the relevant questions are:

- *Which hardware and software components are necessary?*

The first step is to select the computer that will act as a Web server and its operating system. The choice of operating system is a critical one, since many other software components (Web server, mail server, etc.) will depend on the underlying operating system. The combination of UNIX-based machines running the free Apache Web server is a very common one.

- What is needed to install, configure, and protect the virtual classroom contents?

Installation, configuration, and security protection of a virtual classroom are too detailed and lengthy steps to be mentioned in this paper . At this point it is strongly advisable that the instructor and her technical support team rely on specialized books, tutorials, and the experience system administrators.

Step 10 - Maintain and update the virtual classroom

Creating a virtual classroom demands a lot of work, but that is just the beginning. As with any other computer-based information system, the virtual classroom requires maintenance and frequent updates to retain its usefulness. Some of the questions involved are:

- *What are the media, software, and policies for backup?*

Backups are essential maintenance measures in any computer-based system and virtual classrooms should be no exception. The most common contemporary backup devices are zip disks, tape drives, and magneto-optical disks. Many backup utilities (several of them operating system-specific) are available to make the task easier and reduce the risk of human errors.

There are some issues of backup policy that have to be established and strictly followed, such as:

- Scheduling policy (when are backups performed)
- Frequency policy (how often)
- What to backup
- Who is responsible

- Which media to use
- Where to store the backup

- *What about software and hardware upgrades and maintenance?*

An inevitable side effect of the rampant progress in computer technology is the frequent need for software and hardware upgrade. Provisions should be made for these tasks, both in terms of cost as well as in the possible technical consequences of such upgrades.

- *Should the site contents and links also be maintained on a regular basis?*

The answer to this question is a big "yes". Once you have actually put the course site online, the real challenge lies in updating and maintaining it. Keeping your site fresh encourages people to return. Poor maintenance is a sure way of getting rid of visitors, perhaps permanently.

Outdated (also known as "dead") links are among the most annoying problems found in many Web pages. There are several site maintenance tools in the market to help keeping the links accurate and up-to-date, such as Adobe SiteMill.

Conclusions

Despite the growing number of online courses available on the Web and the hype around Internet-based learning, the current use of the Web-based virtual classrooms is very limited and subject of intense debate. According to [4], the main factors behind these limited results are: insufficient technical and educational knowledge, reluctance from educators, and lack of resources and institutional support.

This paper tried to bridge part of this gap by providing the reader some useful, up-to-date, and objective information about he process of designing, implementing, and maintaining a virtual classroom. For a lengthier treatment of this subject we recommend [4], [5], [6], and [7]. Useful information can also be found at [9] and [10].

References

[1] Bork, A., and Britton, Jr., D.R., "The Web is not yet suitable for learning". *IEEE Computer*, June 1998, pp. 115-116.

[2] Schank, R.C., "Horses for Courses", *Comm ACM*, Jully, 1998, Vol. 41, No. 7, pp. 23-25.

[3] Neumann, P.G., "Risks of E-education", *Comm ACM*, October 1998, Vo. 40, No. 10, pp. 136.

[4] McCormack, C., and Jones, D., *Building a Web-Based Education System*. New York: Wiley, 1998.

[5] Tiffin, J. and Rajasingham, L., *In Search of the Virtual Class*. New York: Routledge, 1995.

[6] Hiltz, S.R., *The Virtual Classroom*. Norwood, NJ: Ablex, 1994.

[7] Brooks, D.W., *Web-Teaching: A guide to designing interactive teaching for the World Wide Web*. New York: Plenum Press, 1997.

[8] Marques, O., Woodbury, J., Hsu, S., and Charitos, S., "Design and Development of a Hybrid Instruction Model for a New Teaching Paradigm," 1998 ASEE/IEEE Frontiers in Education Conference (FIE '98), Nov. 4-7, 1998, Tempe, Arizona, pp. 90-94.

[9] Kilby, T., "Rules for Good WBT Design". http://www.filename.com

[10] Kilby, T., "The Development Process". http://www.filename.com

[11] http://homepage.interaccess.com/~cdavis/edit_rev.htm.

[12] Hsu, S., "HWSAM: A Web-based Automated Homework Submission System", 1998 ASEE/IEEE Frontiers in Education Conference (FIE '98), Nov. 4-7, 1998, Tempe, Arizona, pp. 580-582.

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[13] http://www.webct.com
[14] Classroom Connect. "Educators Internet companion." Wentworth Worldwide Media, Inc. Lancaster, PA, 1996.
[15] Jonassen, D.H., Peck, K.L., and Wison, B.G. "Learning with Technology: A constructivist Perspective", New Jersey: Prentice Hall, 1999.
[16] Hamza, M.K., and Alhalabi, B. "Touching Students Minds In Cyberspace: 10 Creative Tips", *Learning & Leading with Technology*, (in press)-Vol. 26, No. 6, 1999.
[17] Jonassen, D.H., "Computers In The Classroom: Mindtools for Critical Thinking", New Jersey: Prentice Hall, 1996.